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ABSTRACT

This report examines how the curricular offerings of large secondary schools compare with the curricular offerings of small secondary schools. The study is motivated by theories of production which hold that economies are available in large compared to small schools; it is pointed out, however, that larger schools may not take advantage of existing size economies or may take advantage in varied ways. The first section of the paper reviews ways in which the curriculum of a larger secondary school can differ from that of a smaller secondary school and notes reasons for expecting one type of difference rather than another. Topics include analysis of the relationships among educational services, variation in the mix of services, variation in the means employed to provide services, and the cost of services. The second part of the paper presents an empirical assessment of the relationship between scale and the incidence of the various curricular responses. The conclusion discusses policy implications related to the findings of the study which make a convincing case for maintaining secondary enrollment levels at the 400-pupil level. (JHZ)

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Secondary School Enrollment and Curricular Comprehensiveness

by
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Organizational Alternatives for Small-Rural Schools In New York State*

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Introduction

This is a study of how the curricular offerings of large secondary schools compare with the curricular offerings of small secondary schools. The study is motivated by theories of production which hold that economies are available in large compared to small schools. To say that such scale or size[1] economies exist is to say that it is possible for larger schools to operate more efficiently than smaller schools. It is quite another matter to say that larger schools in fact take advantage of whatever scale economies are available to them.

Moreover, even if schools take advantage of the available scale economies, they may do so in a variety of ways. For example, large schools compared to small schools may differ only in terms of average class size and the number of sections they offer of a given set of courses. Alternatively, large schools may attempt to take advantage of returns to specialization by offering additional courses that contribute to the breadth and depth of the curriculum.

The willingness to offer additional courses need not be evenly distributed across curricular areas. Some areas of the curriculum could even grow at the expense of other areas. To the extent that differential curricular growth associated with school size is tied to different classes of students (e.g., students in academic tracks compared to students in vocational tracks), the study of curricular offerings and school size raises equity as well as efficiency issues.

The first section of this paper examines the various ways in which the curriculum of a larger secondary school can differ from that of a smaller secondary school. This section also examines reasons for expecting one type of difference rather than another. Having established why it is reasonable to expect variation, section two presents an empirical assessment of the relationship between scale and the incidence of the various curricular responses. The paper concludes with a discussion of policy implications and recommendations for future research.

Section I: Conceptual Matters

Taxonomy of Response

A useful distinction can be drawn between the mix of services schools offer and the means schools employ to provide their services. This distinction is borrowed from the theory of household production developed by Gary Becker and others,[2] and is applied in this context to the production of education.

An educational service is defined as a combination of resources devoted to the production of a given set of learning outcomes.[3] By restricting the definition to resource combinations intended to produce "learning outcomes,"

we limit the scope to services that are instructional in their nature. We further limit the scope to instructional services that manifest themselves in the form of a curriculum that consists of a finite number of explicit courses of study.

Each section of a course counts as an educational service. For example, biology instruction is an educational service and is produced by combining units of teachers' time, students' time, capital inputs (e.g., space, texts, and equipment) and consumable inputs (e.g., paper, pencils, illumination, etc.).

One service can be distinguished from another by the set of learning outcomes produced. Each unique set of outcomes corresponds to a particular service. The mix of services offered will vary across schools in the degree to which different sets of learning outcomes are pursued.

Broad subject areas (science, mathematics, social studies etc.) can be used to help distinguish among the various instructional services schools provide. Thus, there will be variation in the service mix both across and within subject areas.

Services also vary in terms of the means employed to pursue a given set of learning outcomes. Some biology instruction might emphasize auto-tutorial methods while some other biology instruction might rely heavily on lecture-recitation methods. So long as the set of learning outcomes remains the same,[4] the differences count as differences in the means employed to produce a given service rather than differences in services.

Variation in the mix of services. The mix of instructional services offered by schools will vary in terms of how comprehensive it is. Comprehensiveness varies along at least three dimensions. First, the service mix can vary in terms of its breadth. The larger the number of discreet subject areas attended to, the greater is the breadth of the service mix.

Second, there can be variation in the depth of the offering in particular subject areas. Curriculums vary in terms of how many sequentially arranged courses there are in particular subjects. The larger number of sequentially arranged courses in a subject area, the greater is the depth of the offering. Given that depth is tied to particular areas of the curriculum, curriculums can be described in terms of both the average depth and variation in depth among subject areas.[5]

Third, the service mix can vary in terms of how accessible it is to students. If a given course is offered only once during a day, a student will have to choose between it and the competing courses offered simultaneously. In contrast, if the service is offered more than once there is a chance that flexibility will be greater, and the student may have a better opportunity to satisfy both internally set and externally imposed educational goals. Multiple offering is a necessary but not a sufficient condition for increasing accessibility.[6]

Each of these three dimensions along which curriculums can grow (breadth, depth, and accessibility) is associated with costs. Moreover, opportunities for joint production along any two of the dimensions are limited. It follows that tradeoffs among the three dimensions are endemic and cannot be avoided. The pursuit of one rather than another of the three dimensions is an administrative decision. It is this decision that we seek to understand more completely.

The balance between breadth, depth, and accessibility need not be the same across subject areas of the service mix. For example, the vocational curriculum need not grow in the same way that the English curriculum grows. Evenness in the growth of a curriculum and the related equity issues are dealt with elsewhere and will not be emphasized here.[7]

Variation in means employed. There are any number of ways in which the means employed to provide a service can vary. In an earlier study, we examined variation in the rate at which material resources were combined with hired human resources.[8] In this analysis, we focus exclusively on hired human resources, specifically teachers, and examine the allocation of teachers across subdivisions of the service mix.

The nature of teachers' assignments can vary in a number of ways. First, there may be variation among teachers in the number of classes taught. Some teachers may teach five classes, others may teach four or six classes of the same length. For teachers teaching fewer classes, there may or may not be additional assigned duties.

Second, among teachers with the same number of assignments, variation can exist in how many different classes the teacher must teach. In other words, the number of different preparations may vary among teachers with ostensibly the same number of assignments.

Third, teachers may vary in the degree to which they teach within a single subject area. For example, teachers may teach only in one subject area, and thus specialize at the subject area level. A teacher with this type of assignment might teach nothing but mathematics courses at the secondary level (algebra, business arithmetic, geometry, trigonometry, and calculus).

Alternatively, teachers may teach courses in two or more subject areas. Such teachers have a diversified assignment across subject areas and might teach courses in mathematics and, say, science.

Fourth, variation can exist in the degree to which teachers specialize within a given subject area. Two teachers might teach exclusively within a given subject area, say, mathematics, but one teacher might teach five sections of the same algebra class while the second teacher teaches one section of five different mathematics courses.

Thus, there are at least four dimensions along which teacher assignments vary: (1) the number of classes taught, (2) the number of preparations, (3)

the degree of specialization across subject areas, and (4) the degree of specialization within subject areas.

A Resource Allocation Model

Having explored the various ways in which curriculums can vary as they grow larger, we can now ask questions about why one type of growth is more likely than another. We posit a simple model wherein the mix of services and the means employed are related to the tastes of a community and the relative prices of the services. The prices of the services are related, in turn, to the size of the schooling organization. We shall not have much to say about variation in tastes for particular mixes of services and the means employed to provide them. Rather, the emphasis shall be placed on the impact differences in prices can have on the service mix and means.[9] The ultimate task is to assess the degree to which price variables explain the variation we observe in the development of curricula.

The more immediate task is to explain a) the meaning of a service price, b) why size is related to service prices, and c) why service prices are related to the mix of services and the means employed.

Service prices.[10] Recall our definition of an educational service: a combination of resources devoted to the production of a given set of learning outcomes. Suppose we divide the resources into two categories: 1) those resources purchased by the schooling organization and 2) those resources supplied in other ways to the schooling organization. An example of the former would include the time of a teacher while an example of the latter would include the time a parent spends helping a child with homework.

These inputs will vary in terms of their productivity. A unit of one input may contribute more to the production of a given service outcome than will a unit of a second input. It follows that a one unit rise in the outcome level of a service will require a greater quantity of the less productive resource than of the more productive resource. Let a_j measure the number of units of the jth purchased input required to increase the outcome level of a particular service by one unit. Let b_j measure the number of units of the jth non-purchased input required to raise the level of a particular service by one unit. The a's and b's are the inverses of the inputs' marginal productivities.

Both purchased and non-purchased inputs are costly in the sense that opportunities are foregone when they are utilized. Let P_j measure the opportunity cost associated with the jth purchased input and W_j to measure the opportunity cost associated with the jth non-purchased input. The product of a_j and P_j will measure the jth purchased input's contribution to the unit cost of the service in question. Similarly, the product of b_j and W_j will measure the jth non-purchased input's contribution to the unit cost of the service.

By calculating the products of the input-output coefficients and the unit costs for all inputs and by summing them, we will obtain an expression

which represents the total or full cost of a unit of the service in question. Algebraically, we have:

$$(1) \qquad S_i = \sum_j a_{ij} P_j + \sum_j b_{ij} W_j$$

where S_i is the full unit cost of the ith service.

The linkage between size and the cost of services. In this paper we are primarily interested in the allocation of purchased resources. We shall therefore focus attention on the $a_{ij}P_j$ term in equation (1).[11]

At any given moment, let us assume that there is a finite number of n instructional services that in principle could be offered.[12] Moreover, at any given moment, there are two classes of teacher resources, those that are already employed by the school and those that are not. If we hold P_j constant, we can conceptualize the currently not hired teachers as those who would be willing to work in the school at the given wage P_j. What we are doing is defining the labor market that exists at a given wage for the school in question.[13]

Say there are m teachers already hired and t teachers who would work in the school at wage P_j. The total number of teachers would be m plus t.[14]

Considering first those teacher resources that are already hired, the productivity of these teacher resources will vary depending on how they are assigned to the various service offering possibilities. Were a teacher trained in French assigned to a mathematics course, the teacher's productivity presumably would be lower than if the same teacher were assigned to a French class.

The coefficient a_{ij} measures the quantity of the jth teacher resource required to raise the ith service level one unit. The larger is a_{ij}, the less productive is that particular teacher when assigned to that particular service. There will be one a_{ij} for each unique combination of teacher and possible service offering.

To suggest that a single coefficient (a_{ij}) can reflect the productivity of a given teacher in a given assignment is deceptive. Surely the productivity of the teacher will depend in important ways on the availability of other resources, including the number and characteristics of students. It is more reasonable to view each a_{ij} as a separate matrix in which all the possible combinations of resources are depicted and the entries reflect measures of how productive the teacher would be given each alternative combination of resources.

Some of these possible resource combinations will involve settings where the class size is small; others will involve settings where the class size is large. Later we shall argue that the productivity of the teacher resource assigned to a given service will vary systematically depending on the number of students involved in the instruction.

We, therefore, have a matrix in which each entry measures the productivity of each teacher in each possible use. Many of the entries will be hypothetical in the sense that the question being asked is how productive would this teacher be <u>if</u> the teacher were assigned to a course that is currently not being offered.

A similar matrix can be constructed for all of the teachers in the school's labor market but not currently employed by the school. These matrices are depicted in Figure 1.

Figure 1 About Here

We can use production theory to make two claims about the linkage between size variables and the magnitude of the a_{ij} coefficients reported in the matrices above. The first is that the aij's vary internally such that within certain limits they are higher when class sizes are smaller.

Recall that each aij is itself a matrix representing all the possible ways the jth teacher could be employed in the production of the ith service. What we are claiming is that class size (the number of students being combined with the teacher resource) is directly related to the productivity of the teacher, at least within certain limits.

The rationale for this claim stems from an implicit assumption regarding diminishing marginal returns associated with teacher resources as well as from an assumption that class size is inversely related to individual students' supplies of teacher resources.[15]

The second claim has to do with variation in aij for the jth teacher across the n possible services. Before we state the claim it is necessary to make some assumptions about the nature of the variation in teacher productivity across services.

We assume this variation has three characteristics. First, teachers' productivity varies across the service mix such that the variation across subject areas is larger than the variation within subject areas. Second, the incidence of single troughed productivity profiles is greater than the incidence of double troughed productivity profiles, and that the incidence of double troughed productivity profiles is greater than that of triple troughed productivity profiles.

Panel A of Figure 2 depicts a single troughed productivity profile that reflects the assertion that variation across subject areas exceed that within; panel B depicts a similar profile with two troughs. The teacher in panel A specializes in a single subject area; the teacher in panel B is more of a generalist, and specializes in two areas. Although it is true that gains from specialization within subject areas are available for both teachers, the relatively blunt nature of the troughs emphasizes the limited nature of these gains.

Figure 2 About Here

Figure 2 also reflects the third assumption about the characteristics of the variation in productivity across the service mix. The third assumption is that tradeoffs exist between the pursuit of excellence in one area and the pursuit of competence in additional areas.[16]

The rationale for these three assumptions stems from the fact that opportunity costs attend the production of skills and expertise. When you learn one thing, you do so at the expense of not learning something else. So long as resources (financial as well as time) are finite, it follows that tradeoffs between breadth and depth of knowledge will characterize the training of teachers.

By superimposing the skill distribution for each of the m teachers currently employed by a school, we can represent the reservoir of teacher productivity, specific to teacher and subject, for the entire school. A similar profile can be constructed for the reservoir of teacher talent that is available to the school but currently not employed by the school.

The next step is to depict the way in which the school taps the reservoir of productivity available to it. A school may or may not take full advantage of the talent that exists on a faculty, and it is here that the size of the school, something distinct from the size of the class, becomes a factor.

The size of the schooling organization as measured by enrollment is related to the ability of administrators to take advantage of the productivity differentials that characterize the reservoir of teacher talent.

In a small school, there is less demand for additional courses in a given subject area than in a large school. The likelihood of a teacher being assigned to more than one subject area is therefore higher in the smaller school. Assuming we are correct about the greater incidence of single peaked teacher ability profiles, the smaller school will have to make due with lower teacher productivity levels than the larger school. The same result obtains, though presumably not to the same degree, even if the smaller school is able to hire teachers with double or even triple peaked productivity profiles due to the loss of excellence we assert accompanies greater breadth in areas of competence. It follows that school size is related to the productivity coefficients that can be realized for each of the services provided by the school.

Summarizing, class size affects productivity to the degree that class size is related to pupil specific resource flows and to the degree the diminishing marginal returns are characteristic of important educational resources such as teacher inputs. School size affects productivity through its impact on the ability of administrators to draw upon the reservoir of teacher talent available to the school. Note, this reservoir has two components, the group of teachers already employed and the group currently not employed (but available at the given price) by the school.

We have established links between size and the service cost variables. The next step is to examine the link between cost and the mix of services and the means employed to provide the services.

Link between costs and service mix and means. The question now becomes: How likely is it for the larger schools to take advantage of the lower aij's that the production model asserts are available? Consider the following three perspectives.

First, there is the nihilist view. Herein the claim is that the productivity coefficients are largely irrelevant to those making decisions about curriculum offerings and staffing assignments. Tastes are said to determine these matters, and these is little rhyme or reason to the formation of the underlying tastes. Moreover, there are the tastes of the teachers involved (I want to teach this, but not that) as well as the collective tastes of the community (parents, taxpayers, central government officials, etc.).

If gains in efficiency are irrelevant, then we ought to see no systematic relationships between the size of a school and a) the mix of services offered and b) the means employed to provide the services.

Second, there is the naive economist's perspective. Herein schools are viewed as purposive organizations that seek to operate efficiently. The availability of lower aij coefficients is sufficient to lead to their adoption.

According to this view, there are causal links between the aij's and resource allocation practices that manifest themselves in the form of course mixes and teacher assignments. The aij's are one part of the service price variables (see equation (1)) and as we saw above, the size variables are related to the aij's. Hence, there is a conceptual link between the size of a school and the internal allocation of curricular resources.

The commitment to efficient operation will lead to systematic differences between small and large schools such that a) larger schools will operate larger class sizes (thereby taking advantages of diminishing marginal returns), b) larger schools will offer curriculums with greater breadth and depth, and c) teachers in larger schools will have more specialized assignments. Specifically, teachers in large districts are more likely to teach in a single subject area. Moreover, they are likely to specialize in the teaching of a single course.

The presumption that the mere availability of lower aij coefficients leads to their utilization also suggests that differences in curricular breadth, depth, accessibility as well as teacher assignment characteristics will be remarkably uniform among schools with similar size. This is not to argue that schools of a given size will all offer the same courses. Rather, the claim is that schools of a given size will be similar with respect to the number of different subjects offered, the depth of the offering in whatever subjects are offered, the willingness to offer multiple sections, and the

tendency to have teachers specialize at both the subject and the course level.

Finally, there is the sophisticated economist's perspective. Here the commitment to the maximization principle is maintained, but is broadened to include additional goals that can be pursued. In addition, the sophisticated economic approach pays close attention to the sometimes subtle constraints that limit the ability of schools to take full advantage of the efficiency gains promised by larger size.

This view recognizes the need for a balance between breadth, depth, and availability; it also recognizes that one is pursued at the expense of the others. Moreover, it recognizes that the balance will depend on (a) the productivity profile of the existing teacher talent (Matrix T in Figure 1); b) the productivity profile of the available teacher talent that is currently not employed by the school (Matrix T* in Figure 1); c) administrator knowledge of Matrices T and T*; d) restrictions contained in contracts on the involuntary transfer of teachers across assignments; e) the availability of additional resources that can complement or substitute for teacher resources; and f) goals that compete with efficient operation.

Notice that this view holds open the possibility that the Matrices T and T* in Figure 1 may vary among schools. In other words, it is not the case that there are two matrices (T and T*) that apply to all schools in a region or nation. Rather, the matrices themselves are dependent on the value of P_j, the price that the school offers for the teaching talent. As P_j varies, so also will the pool of existing and available talent. Hence, although it is difficult to deduce the precise nature of the two matrices and this limits our ability to predict how schools will respond to changes in size, we can expect schools that offer different P_j's to respond in different ways.

This view does not deny the importance of tastes in the determination of the mix and means of the services provided. Rather, it is a matter of emphasis, and a presumption that tastes are inscrutable.

What follows now are seven propositions that grow out of the sophisticated economic view. The first four propositions deal with the relationships between school enrollment levels and the mix of courses offered

Course Availability Propositions

> Proposition 1: There is a strong and uniform aversion to small class size that exists in schools regardless of their size.

If the proposition is correct, we can expect to see a small and relatively uniform incidence of small classes across schools of different size. Only in the very smallest schools is it reasonable to expect to see small class sizes on the average. This occurs because in these settings the

further combining of classes can be achieved only at a substantial loss of teacher efficiency. Recall the tendency for teacher productivity profiles to vary more across than within subject areas. It follows from this that classes within subjects can be combined with relatively little loss in teacher productivity (e.g., different mathematics courses can be combined into a single or a small number of courses). Thus, the advantages of larger class size can be had without the drawback of substantial losses in teacher productivity.

However, when student numbers decline to the point where the combining of courses requires the mixing together of distinct subject matters (e.g., English and foreign language), the losses in teacher productivity will begin to outweigh the gains associated with the avoidance of small classes.

How reasonable is it for administrators to eschew small classes? Certainly arguments can be made on behalf of small class size. It is common to assert that the affective side of students' development is better dealt with in small settings. Also, there is some evidence that cognitive gains are associated with small class sizes.[17] However, there are three points to be made in support of proposition 1.

First, the evidence on the learning gains associated with small class sizes is at best mixed and in any case does not suggest that the gains to be had are large. These unclear gains must be balanced against the obvious and large expenditures per pupil that small classes entail. Moreover, the affective gains while they may be large are difficult to measure and, partly as a consequence of the measurement problems, have not attracted as much attention as the cognitive gains.

Second, small class sizes raise equity problems for administrators. For one thing they raise questions about equity among teachers in the distribution of assignments. Is it fair for some teachers to have small classes while others do not. The desire to give everyone the same number of small classes only adds to the complexity of the teacher assignment problem. If all the classes are of roughly the same size, there is one fewer thing for the administrator to worry about.

Third, the inefficiencies that stem from a failure to specialize both the curriculum and the teacher assignments gains from specialization may not be very large in any case. The prevailing wage P may be so low that the schools are not able to attract true specialists. Rather, they attract generalists that are interchangeable. Certification requirements are often minimal.[18] Of course, the low Pj may be more of a consequence than a cause of the aversion to small class size. In other words, the low Pj's may stem from the underlying aversion to small class sizes.

There is one argument to be made in opposition to Proposition 1. While it may be true that administrators harbor a deep seated aversion to small class sizes, they can also be expected to resist situations where teachers are not carrying full teaching loads. These two goals can work against one another since a refusal to offer classes when enrollments become too low can lead to instances where some teachers carry lighter loads (i.e., fewer

teaching assignments) than others. For the sake of giving the appearance of fully employing the employed teachers, there may be a reluctant tolerance of small classes.

> Proposition 2: There are well defined limits on the willingness of large schools to offer specialized curriculums.

Although it may be the case that administrators are more sensitive to inefficiencies stemming from small class size than they are to inefficiencies stemming from a failure to specialize, it does not follow that they are insensitive to the returns of specialization. Indeed, the two sources of savings operate at cross purposes. On the one hand larger schools can offer more specialized courses, but in so doing they will find themselves offering classes that are smaller than needs to be the case in the absence of the specialized offerings.

The gains from specialization come from the better utilization of the reservoir of teacher talent available to the district (i.e., the aij coefficients will be lower because of the better match between teacher capabilities and subjects being taught); the drawback from specialization comes from the oversupply of teacher resources in small class settings.

Given a fixed Pj, there are limits on the range of talents available to schools in the two reservoirs of teacher talent. (There are also limits on the demands made by students for specialized courses.)

Thus, we can expect limits on the willingness of larger schools to offer specialized offerings. This reluctance to specialize will manifest itself in several ways. First, there will be limits on the numbers of small courses offered. Even the largest schools can be expected to limit their offering of small courses.

Second, there will be limits on the breadth and depth of the curriculums that are offered. Beyond some point, larger schools will differ from smaller schools in the number of sections offered of a given mix of courses. In other words, beyond a certain enrollment, larger schools will simply offer more of the same relative to smaller schools.

> Proposition 3: The willingness to take advantage of returns to specialization varies substantially among schools with the same enrollment level.

Recall that the returns to specialization are tied to (a) the productivity profile of the existing teacher talent (Matrix T in Figure 1); b) the productivity profile of the available teacher talent that is currently not employed by the school (Matrix T* in Figure 1); c) administrator knowledge of Matrices T and T*; d) restrictions contained in contracts on the

involuntary transfer of teachers across assignments; e) the availability of additional resources that can complement or substitute for teacher resources; and f) goals that compete with efficient operation.

Also recall the arguments about the linkage between Pj, the prevailing wage, and the nature of the two teacher productivity profiles. The higher Pj, the more internally varied the productivity profiles are likely to be and the greater will be the potential for realizing returns to specialization. In contrast, when Pj is low, the profiles are likely to be less internally varied, and the potential for realizing returns will be small.

Given the range of factors influencing the magnitude of the potential returns of specialization, and given the likelihood that these factors will vary substantially among schools, we can expect substantial variation in what specialization offers schools of a given enrollment level. In keeping with the economic model we are exploring, it follows that schools of a given size will vary substantially in the degree to which they specialize their course offerings.

We can, however, go further and hypothesize that the price level will be related to the level of curriculum specialization such that schools paying higher wages will be more likely to offer specialized course offerings. This hypothesis is based on the linkage we have described between the wage paid (Pj) and the internal variation in the two teacher productivity profiles.

> Proposition 4: Problems of access are not unique to small schools.

One of the administrative strategies for balancing the advantages of specialization with the drawbacks of small class size is the offering of single section courses. By requiring all students interested in a particular course to take it at a single time, enrollment is enhanced and returns to specialization are realized. What is lost is accessibility and flexibility. The incidence of single section offerings, otherwise known as "singletons," within a curriculum provides a measure of accessibility.[19]

The alleged aversion to offering small classes coupled with the desire to realize whatever returns to specialization are available provides an incentive for schools to offer singletons regardless of their enrollment. Indeed, since the ability to take advantage of returns to specialization increases with size, unless there is reason to believe that the desire to increase accessibility of courses for students is positively related to school size, we can expect a steady if not increasing incidence of singletons in larger compared to smaller schools.

Teacher Assignment Propositions

> Proposition 5: Heavier teaching loads (where heaviness is measured by the number of sections taught as well as by the number of different preparations) exist in schools where classes are small.

This proposition is a byproduct of the aversion to small class size. When administration can find no way to avoid offering small classes (i.e., it has combined classes to the point where the further drop in efficiency is greater than the inefficiency produced by the small class size), it will attempt to recover some of the associated costs by imposing additional duties on teachers. To the degree that teachers are not compensated for these additional teaching duties, they bear a portion of the cost associated with the small class offerings.

However, it may also be the case that teaching smaller classes constitutes a benefit for teachers, and that the extra class assignments offset the benefit associated by teaching smaller classes. If these two features of the teachers' employment balance one another, there is no substance to the claim that teachers bear a portion of the cost associated with operating small schools.

> Proposition 6: There is greater sensitivity to the productivity losses associated with teachers teaching in several subject areas than there is to the productivity gains associated with teachers specializing in the teaching of particular courses.

To say that administrators are primarily concerned with keeping class sizes large is not to say that they are indifferent about whatever specialization they can achieve. As schools become larger it becomes more possible to reduce the number of different subjects teachers teach and to increase the incidence of teachers teaching multiple sections of the same course. The question is which is assigned the higher priority.

Earlier we argued that within subject area productivity differences tended to be smaller for teachers than across subject area productivity differences. Thus, the productivity profiles we drew for teachers were characterized by relatively blunt troughs. The rationale we offered was that teachers tend to train in subject areas rather than in the teaching of particular courses.

If we are correct about this, the administrative strategy described in Proposition 6 can be understood as an outgrowth of a commitment to efficiency.

Proposition 7: An upper bound exists on the degree to which teachers specialize in the teaching of particular courses.

The blunt nature of the trough in teacher productivity profiles means that there is not much to be gained from having teachers specialize in the teaching of particular courses. Again, this bluntness stems in part from the prevailing P that is available for teachers. Were P higher, returns to specialization within subject areas would be enhanced, and we could expect a greater incidence of teachers specializing in the teaching of particular courses. Thus, we might hypothesize that Pj is related to the incidence of specialization within subject areas.

However, it is conceivable that there are limits to how good one can become at teaching a particular subject matter. It is also conceivable that even if such limits do not exist, that there are drawbacks including boredom that can stem from teaching the same course numerous times.

It follows from this that the number of preparations (i.e., the number of different courses taught) will not decline steadily with school size. Rather there will be a floor below which the number of preparations is unlikely to fall regardless of how large the school becomes.

Section II: Empirical Analysis

Methods

New York State collects on an annual basis extensive information about the characteristics of its public school teachers including detailed information about each of the teachers individual teaching assignments.[20] By manipulating these data it is possible to construct the course offerings of each school in New York State as well as the characteristics of the teachers teaching each of the courses.

There are, however, several problems associated with these data. First, New York State's secondary schools are organized in many different ways. A school might contain the top four grade levels or the top 6 grade levels. Or in some cases, the schooling organization is so small that all grade levels (elementary as well as secondary) operate together and it becomes difficult to conceptualize what counts as the secondary school.[21]

Second, teachers often have assignments that cut across different student age levels. For example, a teacher might teach mathematics to 13 as well as 16 year old students. Indeed, this is in itself a type of generalization (vs. specialization at one age level) that varies among

teachers and could be studied. These split assignments can even occur when the middle or junior high school is operated as a separate school.

The enrollment figure employed below is the enrollment of students in the top four grade levels (9-12) of the schooling system. On the teacher side, the only assignments excluded are the full time elementary assignments and the special education assignments. Thus we are comparing the assignments of non-elementary and non-special education teachers in schooling systems whose enrollment levels vary in the top four grade levels.

Third, it is not uncommon in New York State for schools to employ part-time teachers. The courses offered by these part-time teachers are included in the analysis of curricular offerings (the mix of services provided), but are not included in the analysis of teacher assignments. The latter analyses are restricted to the full time teachers employed by the schools.

It is also not uncommon for New York State schools to offer courses during a portion of the school year. These part year courses may or may not be taught by part-time faculty. We distinguished between two classes of courses, those offered more than 20 weeks during the year and those offered 20 or fewer weeks during the year. Each group was analyzed separately.

The data reported below describe the 1984-1985 curricular offerings in New York State schools. We drew two kinds of samples. For the first sample, a set of secondary enrollment levels was chosen. This set included the following enrollment levels: 100, 200, 300, 400, 500, 1000, 1500, 2000, 2500, and 3000. The population of school districts with the indicated enrollment level was identified for each enrollment level. The enrollment level was then alternately increased and decreased by one student and the selection procedure was repeated until a total of 10 school districts had been identified with enrollments in the neighborhood of the specified enrollment levels.

This method yielded 10 groups of school districts. Each group contained 10 districts with enrollments equal or close to the enrollment levels of interest. Thus, we are able to compare all of New York State's districts with 100 students enrolled in grades 9-12 with all of New York State's districts with 200 students enrolled in grades 9-12. Similar comparisons are possible across all of the enrollment levels we identified. We employed a finer grained set of enrollment levels for the districts with < 500 students given the widespread belief that these districts offer inadequate programs and that reorganization is the most viable policy alternative.

The second sample is a random sample of all New York State school districts, excluding the five largest city districts in the State. The results reported below are based on the first sample. The analysis of the second sample is in progress.

Results

Class size. According to Proposition 1 there is a strong and uniform aversion to offering small classes. When we compared the average class size in districts of different size, we found a remarkable degree of consistency. The results in Table 1 indicate that once a school enrolls 400 students, the average class size for full year core[22] courses varies very little. This result suggests that whatever savings are associated with offering larger classes in larger schools is exhausted by the time school enrollment reaches 400 students, a level that is considered small by New York State standards.

Table 1 About Here

Part year core classes and both the full year and part year vocational classes show a tendency to grow larger over a wider range of school enrollment levels. However, by the time 1000 pupils are enrolled in the school, there is little evidence of classes growing larger with additional enrollments in the school.

Table 1 also reveals information about the incidence of small classes in school districts with varying enrollment levels. Looking first at the full year core offerings, notice the step like nature of the relationship between the incidence of classes with fewer than 10 students and school enrollment. When the school contains 100 pupils, 23 percent of its classes enroll fewer than 10 students. By the time school enrollment reaches 200 students, the incidence of these fewer than 10 student classes drops to 15 percent. When school enrollment is 400 or more, the incidence is, with one exception, in the neighborhood of 10 percent.

Similar results can be found in the table for classes with fewer than five students. Once school enrollment reaches 400 students, these very small classes comprise no more than 5 percent of all classes offered. By the time school enrollment equals 200 students, virtually half of all the core classes contain 20 or more students.

What these results tell us is that school enrollments do not have to be very large before classes are filled to levels found in considerably larger school systems. These data are consistent with the claim that administrators assign a high priority to increasing class size.

These data also tell us that larger schools do not use whatever savings they realize from economies of scale to increase the incidence of small presumably specialized course offerings. There is a remarkably consistent low incidence of small classes in larger schools.

The availability of courses. The aversion to offering small classes has implications for the relationship between school size and the breadth and depth of the secondary curriculum. Earlier we reasoned that the reluctance to offer small classes coupled with the limited degree to which the existing and available pool of teacher talent can generate returns to specialization would lead to ceilings on both the breadth and depth of the secondary curriculum in small compared to large schools. Recall that this was the

thrust of the second proposition. Tables 2 and 3 examine the quantity, breadth and depth of curricular offerings in schools of different size.

Table 2 About Here

Contrary to our expectations, Table 2 reveals a steadily increasing number of different full year core course offerings as school enrollment levels increase. Similar results are reported for the vocational and part year courses. It is certainly not the case that after some mid level of enrollment, say 1500, the number of courses offered remains relatively constant. Rather, the number of different courses continues to increase with school size throughout the range of school sizes we studied.

Table 3 breaks the total number of different courses offered into measures of breadth and depth. Breadth is a count of the number of subject areas covered; depth is an average of the number of courses in each subject area.[23] According to Table 3, a ceiling does exist on the breadth of core courses offered. After school enrollments reach 1500, there is little change in the average number of subject areas offered.

Table 3 About Here

Further analysis revealed that most of the growth in breadth between schools with 100 and 1000 pupils was accounted for by increases in the number of foreign languages. When we removed the effects of different foreign language (in effect treating all foreign languages as a single subject area), the number of subject areas ranged between a low of 8.1 in the smallest schools and 9.5 in schools with 2500 students. A step-like relationship was revealed following this adjustment for foreign language. The steps occurred at the 100 to 200 levels (moving from 8.1 to 8.9) and again at the 1000 to 1500 levels (moving from 8.7 to 9.3).

The measure of depth increases with school enrollment levels with no apparent bound. Thus, it appears that the reluctance to offer small classes is not so large that is stands in the way of offering new courses. It is possible for the large schools to offer new courses that draw large enrollments. A more sophisticated measure of depth than we employ here would permit drawing a distinction between offering new courses at an elementary level (say introduction to astronomy with no pre-requisites in a secondary science program) and new courses at an advanced level (say, nuclear physics with calculus and physics pre-requisites).

Although this more sophisticated measure of depth continues to elude us, we made progress in this vein by looking separately at specific areas of the secondary curriculum. We singled out English, foreign language, mathematics, and science for intensive analysis. Our goal was to find out precisely what courses are offered and how commonly they are offered in schools of differing sizes. Tables 4-8 report the results of these analyses.

Tables 4-7 About Here

Looking at English first in Table 4, we find that while it is true that small school English curriculums are limited, it is also true that large size in itself is no guarantee of a diverse English curriculum.

There are several lessons to be learned from a table like Table 4. First, there are not large differences between what is available in a 100 compared to a 500 pupil district. Notice the figures for Advanced Placement English. No more than 30 percent of the districts in the size categories 100 - 500 offer this course. It is not until school enrollment reaches 1000 that a 60 percent level of incidence is reached. Enrollments of 1500 or more are required for 80-90 percent levels of incidence. If the goal is to make Advanced Placement English courses available to students, reorganizations of schools such that small schools are combined with small schools (e.g., a combination of a 100 pupil with a 200 pupil school) are not likely to achieve the stated goal.

Second, the incidence of the courses available in the larger schools and not available in the smaller schools is rarely high. If we compare schools with more than 500 pupils with those with 500 or fewer pupils, the courses available in the former and not in the latter schools are never offered by more than 50 percent of the districts at the indicated size. Of the 59 courses, 41 of them are available in only 10 percent of the districts at the indicated size. Thus, it appears that large size is <u>not</u> a sufficient condition for achieving a diversified mix of English courses.

Finally, the courses that are available in the larger and not in the smaller schools vary in how specialized they appear to be. Courses with titles such as "British Literature," "Bible as Literature," and "Shakespeare" sound like they are relatively esoteric courses where the enrollment even in a large school is likely to be small. In contrast there are courses with titles like "Science Fiction," "Mystery," and "Sports in Literature" that sound as though they would appeal to a wider clientele.

Tables 5, 6, and 7 provide analogous analyses of the foreign language, mathematics, and science portions of the secondary curriculum, respectively. Similar basic results are to be found in each of these tables, although there are some exceptions. For example, the mathematics offering in even the smallest schools is considerably more differentiated than is the case for the other subjects.

Notice that the calculus course is never offered by more than 60 percent of the districts at the indicated sizes. This is an important finding because the absence of courses like calculus from the school's curriculum is one of the traditional rallying cries for reorganizing schools into larger units. Here we find that calculus is not as common in larger schools as some large school advocates tend to suggest. Similar results apply to advanced placement mathematics, advanced placement chemistry, and advanced placement physics. Advanced placement biology is available more widely in the larger districts; its availability approaches 60 and 70 percent.

Additional analysis of enrollment levels showed that a relatively small proportion of students in the larger schools enroll in the courses that are

not available in the smaller schools. When we selected all of the courses that are available in the schools with 500 students and summed the number of students enrolled in each, we found that this number was equal to 7.56 percent of the students in the 500 pupil schools. In other words, less than 10 percent of the students in schools with 500 pupils enrolled in classes that are not available in schools with 100 pupils.

Going further, we calculated the percentage of students in schools with 1000 pupils that enrolled in English courses not available in schools with 100 pupils. This percentage was equal to 11.65. We continued with this analysis comparing increasingly larger schools with 100 pupil schools and found that the percentage for English was never greater than 27 percent.

Table 8 About Here

Table 8 reports the complete results for English as well as the results of the same analysis for foreign language, mathematics, and science portions of the secondary core curriculum. No where in the table does the percentage rise above 27 percent. What these results tell us is that the percentage of students who take advantage of additional courses that larger schools offer is small in an absolute sense.

Hence, not only is the availability of additional courses not guaranteed by larger size, but the number of students who actually take advantage of whatever extra courses are made available is small.

Variation in levels of specialization. Recall the third proposition regarding variation in the degree to which schools take advantage of opportunities to specialize. Table 3 contains measures of the variation among the 10 schools at each enrollment level in the breadth and depth of their course offerings. The coefficients of variation reported in Table 3 indicate that more variation exists in the vocational area of the curriculum than in the core area. Moreover, there is some tendency for the variation among the districts to be relatively large in the middle ranges of enrollment.

This tendency for variation to be large in the middle ranges is not surprising. In small districts constraints are such that districts have little choice but to offer basic and limited programs. However, as size becomes larger, more possibilities become available, only some of which involve offering new courses and subject areas. The drop in variation at the higher levels of enrollment is less easily explained. One possible explanation is that economies of scale continue to be realized throughout the enrollment ranges we studied, and that by the time you reach the highest levels of enrollment the savings are such that even those districts that initially chose to devote their savings to non-curricular uses find themselves augmenting their course offerings.

More instructive analyses of variation among districts in course offerings can be obtained from subject specific comparisons. Tables 9-12 present histograms for each of the four subjects we studied intensively.

Each histogram describes the number of courses offered by the various districts in the given subject areas.

Tables 9-12 About Here

These tables reveal considerable variation in the number of courses offered. They also reveal a number of instances where considerably larger schools offer as many or fewer different courses than smaller schools. This is especially true in the English area. Notice that some of the smallest schools offer a larger number of different English classes than is true for some of the largest schools. One of the 100 pupil schools offers eight different secondary English courses while one of the 3000 pupil schools offers six different English courses.

Care must be exercised here not to overstate the case. Although it is true that the large school offered only six different English courses, it is also true that the large school offered many more sections of its English courses than did the small school. It is possible that the large school offered numerous versions of courses that just happened to carry the same official title. Were this the case, it is not obvious that the large schools curriculum is less diversified than the small school's. Nevertheless, it is important to realize that the number of elective courses is not necessarily high in some of the largest schools we studied.

In contrast, less overlap characterizes the foreign language offerings. The fewest foreign language courses offered by the largest schools (enrollment = 3000) was 11; the largest number of foreign language courses offered by the smallest schools (enrollment = 100) was 4. Overlap is evident when less extreme comparisons are made. This is true for all four of the subject areas we examined.

The overlap evident when comparisons are made across contiguous enrollment categories has significance for policy since efforts to reorganize schools into larger units typically involves changes from one size category to the next or a least a nearby size category. The overlap present in these histograms calls into question the claim that more diverse course offerings are a necessary result of modest increases in school size.

We argued earlier that the degree to which schools take advantage of specialization opportunities is related to the price paid to their teaching talent. Analysis of these relationships is in progress.

Accessibility of courses. The fourth proposition stated that problems of access are not unique to small schools. We measured access in terms of the average number of sections offered of each course and by the incidence of singletons (courses with only one section) in the curriculum. Table 13 presents compares the average number of sections and the incidence of singletons in large and small schools.

The average number of sections per course is positively related to school size. This is a linear relationship. When we treated the average number of sections of each course and the associated enrollment level as

separate data points and calculated the correlation coefficient, we found a correlation equal to .99. The fact that the relationship is so strongly linear is significant since it suggests that there is no enrollment level beyond which districts increase the rate at which sections of existing courses accompany increases in enrollment.

Table 13 About Here

Assuming the incidence of singletons is a good measure of how difficult scheduling is for students, the evidence presented in Table 13 makes it clear that students in the very smallest schools face the most serious scheduling problems. Close to three quarters of the smallest schools' core curriculum is offered as a singleton. Notice the sharp drop in this figure once school enrollment reaches 200. A second substantial drop occurs when an additional 100 students become involved. Once school enrollments reach 400, the incidence of singletons is relatively steady until school enrollments reach 1500. Following a small drop at the 1500 level, the incidence remains in the neighborhood of 30 percent.

Recall that we expected the incidence of singletons to remain steady and possibly increase with school enrollment levels. This expectation is not supported by these data. However, the relatively high level of singletons in even the largest schools coupled with the finding that the number of singletons per subject area is not related to school enrollment in the higher enrollment ranges, suggests that problems of access to courses are not unique to small schools. Although these problems may not be unique to small schools, it is clear that scheduling problems in the very small schools are more serious than elsewhere.

Teaching loads. In Table 14 we shift to an analysis of how teachers are distributed across the various courses schools offer. Columns 1-3 describe the number of classes teachers teach regardless of what the subject matter entails. Looking at column 3 we find that this measure of teacher load indicates that teachers in schools with 500 and fewer students shoulder a heavier load than do others. This is consistent with our claim that teachers in schools where class sizes tend to be smaller are likely to find themselves teaching a larger number of classes.

Table 14 About Here

A similar conclusion can be reached by using the number of different preparations as the measure of teacher load. Column 4 presents these results and indicates that the average number of preparations decreases steadily as enrollments increase to the 400 level. Between 400 and 1500 the number of preparations is steady. We were surprised to find that the number of preparations begins to increase with enrollment beyond 1500. The increase may be related to the effects of recent declines in enrollment in these larger districts. In response to enrollment decline teachers may have been asked to increase the number of different courses they teach as a means of reducing the teaching workforce.

Specialization across subject areas. Recall that we expected to find a greater sensitivity to gains from having teachers teach within a smaller number of subject areas than from teaching more sections of the same course. The data in column 5 indicate a steady decline in the average number of subject areas taught by full-time teachers as enrollments vary between 100 and 300. Past 300 pupils, there is little difference in the average number of subject areas taught by these teachers. The figures in column 6 corroborate this result. Roughly 10 percent of the teachers in schools with more than 300 pupils teach two or more subject areas; the analogous figure for smaller schools ranges between 15 and 26 percent.

There is little evidence to support the claim that administrators are more sensitive to gains to be had from specializing across compared to within subject areas. Looking at columns 7 and 8, it is clear that the incidence of teachers teaching multiple sections of the same course increases substantially at the lower range of school enrollment levels. Fewer than 30 percent of the teachers teach two or more sections of the same course in schools with 100 pupils. When the schools enrollment is 200, this percentage is equal to 53. Enrollment increase beyond 400 students make little difference in terms of teacher specialization within subject areas.

It appears to be the case that administrators in smaller schools assign a high priority to reducing the number of subject areas teachers teacher and to increasing the incidence of teachers teaching multiple sections of the same course.

Limits to within subject specialization. As indicated above, there is an upper bound on the extent to which teachers teach multiple sections of the same course. This ceiling is reached at a modest level of enrollment, 400, and is remarkably consistent.

These results suggest that the gains from the specialization of teaching both across and within subject areas are realized by the time a schools enrollment reaches 400 pupils. Partly this may be due to the low P_j paid to teachers and the blunt nature of the productivity profiles discussed above. If this is the case, P_j ought to covary with the extent to which schools have their teachers specialize. The higher the P_j, the greater the gains from specialization. These analyses are in progress.

Alternatively, these results may be due to a reluctance or unwillingness of administrators to take advantage of specialization gains that may in fact be available. But for this second explanation to be persuasive, there ought to be some exceptions to the prevailing practice of limiting the extent to which teachers specialize within their subject area. The remarkable consistency of the specialization measure over such a wide range of enrollment levels calls this explanation into serious question.

Section III: Implications and Future Research

The results presented above comport reasonably well with the seven propositions that were based on the sophisticated economist's perspective. In contrast, the results run counter to what both the nihilist and the naive economist views predicted. It is clear that school size is related systematically to the mix of services and the means employed to offer instructional services. However, it is equally clear that there are limits on the degree to which schools take advantage of the efficiencies larger enrollments are alleged to offer.

For example, the data demonstrate a remarkable aversion to small classes such that very small secondary programs, those with enrollments in the neighborhood of 500 pupils, offer classes whose sizes are comparable to classes offered in schools with as many as 3000 pupils. Secondary schools with enrollments in excess of 400 are not entitled to make claims about offering disproportionate numbers of small classes.

Limits do exist on the degree to which the breadth and depth of curriculums covey with enrollment, although the data revealed a greater tendency for the number of different courses to increase with enrollment than was expected. Yes, larger schools offer a larger number of different courses. No, it is not the case that beyond a certain point all of the additional courses offered amount to "more of the same."

But, further analysis revealed a large degree of variation in the identity of the courses that are found in large and not in small schools. Large size is no guarantee that courses such as calculus, advanced placement English, advanced placement chemistry, etc. are offered. A remarkable percentage of the larger schools failed to offer these advanced courses. The data suggest in several places that the tendency in the larger schools is to offer additional courses that are more introductory in their nature, presumably as a means of avoiding the offering of small classes.

Moreover, we found that the courses offered in the larger but not the smaller schools are enrolled in by a remarkably small percentage of the student population.

We also found substantial variation in the degree to which larger schools offer diversified and specialized curriculums. Schools of the same size in some subject areas varied more among themselves than they did among schools of different size. The variation may be due to tastes or to uncontrolled differences in wealth, or to the tradeoffs emphasized by what we have called the sophisticated economist's perspective. Although this analysis is not sufficient to ascertain the source of the differences in offerings, the fact remains that substantial variation exists among schools of the same size.

New York State's preference for larger schooling units makes no allowance for district wealth. The state is equally willing to combine two poor districts as it is to combine two wealthy districts. Yet our results

suggest that in terms of curriculum offerings, the results of these two mergers could be very different. Further research is needed to disentangle the effects of different demands for specialization from the effects of the supply side factors emphasized in this paper.

We learned that the incidence of singletons is remarkably consistent in schools regardless of their size. Only in the very smallest of schools is the incidence of singletons high. Once again, by the time a school's enrollment reaches 400, school size makes little difference in terms of the incidence of singletons in a school's curriculum. Assuming the percentage of singletons is a good barometer of scheduling difficulties, these data show that there is little to be gained in terms of scheduling flexibility by increasing school size beyond 400, and that students in the schools with fewer than 400 students face significant scheduling problems.

We also found that teachers in the small schools faced heavier teaching loads, although we were quick to point out that the additional classes and preparations were accompanied by smaller average class sizes. Indeed, we linked these two phenomenon and explained it in terms of a byproduct of administrators' aversion to offering small classes.

Efficiency gains stemming from more specialized uses of human resources were difficult to demonstrate beyond school enrollment levels of 400. By the time a school enrolls 400 students, the degree to which teachers teachin more than one subject area as well as the degree to which teachers specialize in the teaching of particular courses is established at levels that are comparable to those found in significantly larger schools. It appears that whatever gains are to be had from the specialization of teachers are realized at relatively low school enrollment levels.

It is worth stressing that this ceiling on returns from this form of specialization is not a necessary facet of educational production. Rather, it likely stems from the low P_j offered to teachers and the resulting shallowness of the troughs we depicted in the teachers' productivity profiles. Were the P_j's paid to teachers raised, the troughs could be expected to deepen, and over time we could expect to see an increased incidence of specialization in the nature of teacher assignments.

These findings call into question some of the conventional wisdom surrounding optimal secondary school size. Rather than estimate a cost function and have to grapple with the numerous associated problems, we chose to approach the issue obliquely by examining directly two of the most important sources of scale economies: economies due to the indivisibility of inputs and economies due to the returns to specialization. What we found is that a tipping point exists at the 400 pupil enrollment level. Below 400, additional students translated into increased success at dealing with indivisibilities (i.e., schools could offer larger classes), improved students' access to courses, and more specialized teacher assignments. Above the 400 level, increases in enrollment made little difference in terms of these indicators.

The findings regarding growth in breadth and depth of the curriculum were less clear cut. The number of courses offered continued to grow with enrollment, but in the subjects we examined closely there was evidence of step functions such that little difference existed between 100 and 500 levels of enrollment. Moreover, we found many instances where larger districts offered as many or fewer courses as did considerably smaller districts. The message these data convey is that an expanded, more specialized, more diversified curriculum is not guaranteed by large enrollment levels alone. A second, and related message, is that it is possible to offer at the 400 pupil level a curriculum that compares quite favorably in terms of breadth and depth with curriculums offered in much larger settings.

In conclusion, the case for maintaining secondary enrollment levels at the 400 pupil level is convincing; the case for maintaining secondary enrollment levels beyond 400 is more problematic. In light of this, blanket policies requiring or encouraging school reorganizations that lead to increases in school size regardless of the starting point are ill advised. Governments would be better advised to treat schools with fewer than 400 pupils differently than those with more than 400 pupils. A more proactive policy regarding the former schools would be consistent with the results presented here. This is not to suggest that reorganizations involving larger numbers should be discouraged. Rather, their benefits are less dependable, and greater reliance on perceptions at the local level about the desirability of a reorganization is indicated.

These findings also have relevance for decisions about the size of new schooling systems. We find less to be gained from enrollments in excess of 400 pupils than is commonly believed to be the case.[24] Our findings suggest building smaller secondary schools than is customary. Indeed, the data reported here would suggest even smaller school sizes than 400 pupils if it could be shown that small class sizes had salutary effects on learning outcomes. The assumption we have carried throughout this analysis has been that small classes entail inefficient uses of teachers' time.

Future research needs to be attentive to a number of matters. First there is the cross-sectional nature of these results. Much of the discussion has been cast in terms of changes in school size. Often what we need to know is what would happen if enrollments changed in a given way. These cross-sectional results are limited in their ability to address these dynamic issues. Fortunately three waves of the curriculum data are now in hand, and longitudinal analyses will soon be underway.

Second, there is the question of evenness in the growth of curriculums as size changes. Do academic offerings expand or contract faster than, say, vocational or special education offerings? Or do subject areas within broad headings such as the "core" offerings vary systematically in their response to enrollment or funding changes. These are at their heart equity issues since different classes of students can be affected differently depending on their course enrollments and the differential impact of enrollment change on the offerings in particular areas.

This research is one part of the growing level of interest in the internal or micro aspects of educational resource allocation.[25] There are any number of instances wherein resources are allocated within educational systems. For each of these instances important questions need to be asked about efficiency as well as equity and the implications for freedom of choice. The work is at an early and in many instances exploratory stage. Much remains to be done and it is heartening to see the increasing amount of attention being devoted by economists and others to these issues.[26]

Notes

1. The terms size and scale will be used interchangeably and will refer exclusively to enrollment levels. For a discussion of alternative ways of conceptualizing size, see David H. Monk, "The Conception of Size and the Internal Allocation of School District Resources," Educational Administration Quarterly, 20, 1 (Winter 1984): 39-67.

2. Gary S. Becker, "A Theory of the Allocation of Time," The Economic Journal 75 (September 1965): 493-517.

3. J. Alan Thomas, "Resource Allocation in Classrooms." Final Report to the National Institute of Education Project, No. 4-0794, Grant No. NIE G-74-0037, University of Chicago, October 1977.

4. This distinction between the service mix and the means employed will not always be straightforward. To argue that every educational effort pursues unique learning goals is to argue that the distinction between service mix and means employed is meaningless.

It is more reasonable to recognize that the similarity across courses in intended learning outcomes is a matter of degree. When the outcomes are similar (e.g., college prep algebra), we shall consider the courses to be providing the same service; when the outcomes are dissimilar (e.g., college prep algebra and history), we shall consider the courses to be providing different services.

5. Jeffrey Pfeffer, Power In Organizations. (Marshfield, Ma: Pitman Publishing Company, 1981).

6. What matters in addition to multiple listing is variation in the services that are offered simultaneously. The greater the variation, the greater the accessibility. In the empirical sections of this paper, because of data limitations, we are forced to use the number of times a service (course) is offered as the measure of accessibility.

7. David H. Monk, "School District Size and Inequities in the Supply of High School Courses." Paper presented at the annual meeting of the American Educational Research Association, Chicago, Illinois, April 1985.

8. Monk, "The Conception of Size."

9. For more on the rational for this emphasis on price to the exclusion of taste, see George J. Stigler and Gary S. Becker, "De Gustibus Non Est Deisputandum," The American Economic Review 67, 2 (March 1977): 76-90; and David H. Monk, "Stalking Full Fiscal Neutrality: The Distinction Between School District Wealth and Tastes," Educational Theory 34, 1 (Winter 1984): 55-69.

10. The conception of service prices developed below draws heavily on Becker's theory of household production. See Becker, "Theory of Allocation of Time."

11. But, see Monk, "Conception of Size" for an example of an attempt to do more with the non-purchased portion of this cost expression.

12. This number might be the count of every unique service currently offered in any school. Future service offerings are not relevant.

13. In centralized systems with fixed wages the nominal portion of P_j is often held constant. This is not the same as saying that the real P_j is held constant since there is more to compensation packages than the nominal wage.

14. Some boundary needs to be imposed. For now assume we are talking about a labor market which might be regional or national in its scope.

15. For more on the measurement of pupil specific resource flows see Byron W. Brown and Daniel H. Saks, "Production Technologies and Resource Allocations Within Classrooms and Schools: Theory and Measurement," in Robert Dreeben and J. Alan Thomas, eds., The analysis of Educational Productivity, Vol. 1. (Cambridge, Mass: Bellinger Publishing company, 1980).15.

16. The figure also reflects the assumption that the effect of specialization in one rather than two subject areas has no different effect on productivity in other areas.

17. Gene V. Glass and M.L. Smith, "Meta-Analysis of Research and Class Size and Achievement," Educational Evaluation and Policy Analysis 1(1979): 2-26.

18. In New York, for example, a major is not even required to teach a subject at the secondary level, just 16 credit hours.

19. Recall that multiple sections of the same course constitute necessary but not sufficient conditions for achieving accessibility. In contrast, single section offerings are sufficient to ensure limited accessibility.

20.Stephen L. Jacobson and Patrick Galvin provided extensive assistance with the data analyses presented in this study.

21. It has been argued that combining grade levels into a single schooling unit offers economies that are distinct from those gained from increasing the number of students being served. These distinct economies have been called economies of scope rather than the more conventional economies of scale. See Emmanuel Jimenez, "Economies of Scope in Primary and Secondary Schools," paper presented at the Northwestern University 1986 Winter Superintendent's Symposium, Evanston, Illinois, January 28, 1986.

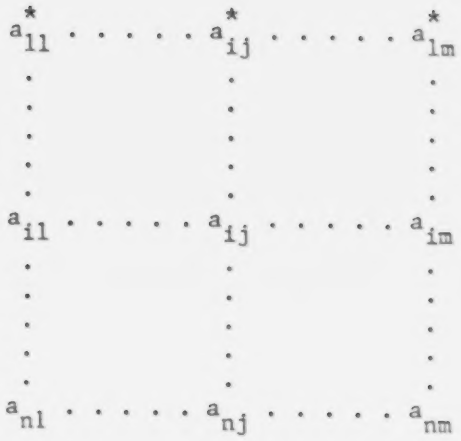
22. Core offerings include the following subject areas: English, foreign language (each language is treated as a separate subject area), mathematics, science, social studies, art, and music.

23. A more sophisticated measure of depth would include consideration of pre-requisites for the various offered courses.

24. For examples of arguments supporting larger secondary schools see Elchanan Cohn, "A Sympathetic View of School Reorganization in Illinois: Lessons From Studies of Scale Economies in Elementary and Secondary Schools." Paper presented at the Northwestern University 1986 Winter Superintendent's Symposium, Evanston, Illinois, January 28, 1986. Also see, School District Organization in Illinois, Illinois State Board of Education, Springfield, Illinois, May 1985.

25. See, for example, Byron w. Brown and Daniel H. Saks, "The Production and Distribution of Cognitive Skills Within Schools," Journal of Political Economy 83 (1985): 571-594; David H. Monk, "Interdependencies Among Educational Inputs and Resource Allocation in classrooms," Economics of Education Review 3, 1(1984): 65-73; and Douglas M. Windham, "Micro-Educational Decisions as a Basis for Macro-Educational Planning." Paper presented at the IIEP Seminar entitled Educational Planning and Social Change, edited by Hans H. Weiler.

26. For example, the American Educational Finance Association is currently considering a proposal for a yearbook devoted exclusively to an assessment of what we know about the internal allocation of educational resources. The yearbook promises to provide a multi-disciplinary approach to internal allocation questions in which economics will play a prominent role.



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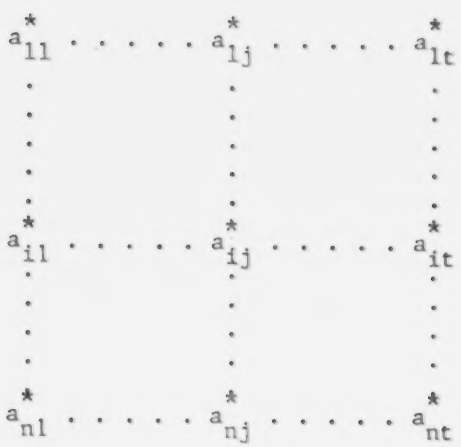

Matrix T^*
Teachers Who Would Work at
the School in Question at the
Offered Wage

Figure 1. Matrices Describing Teacher Productivity Possibilities

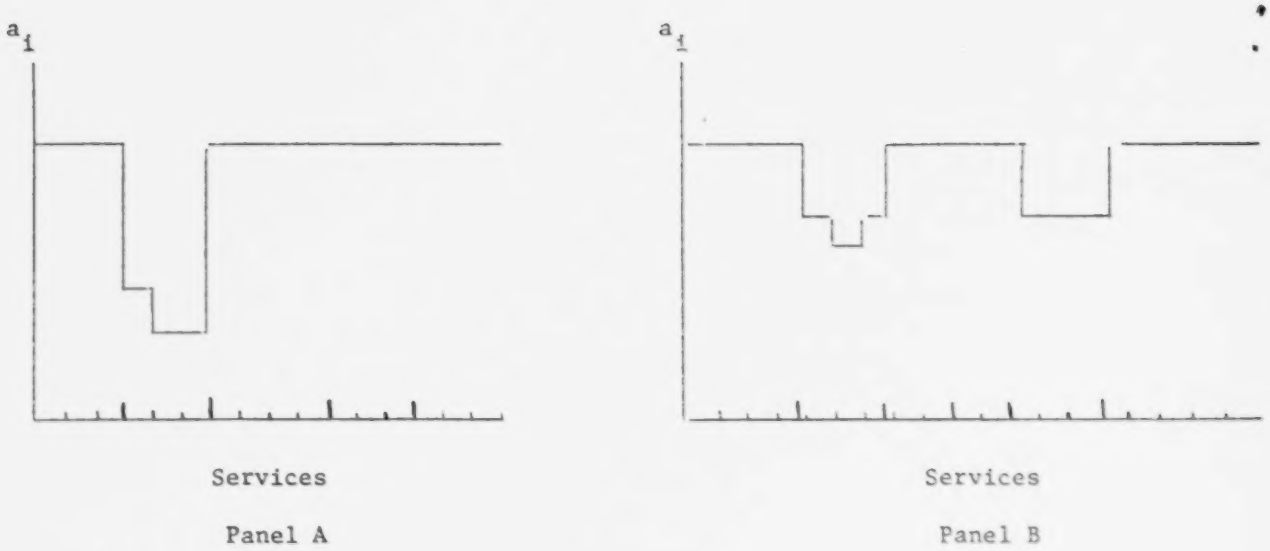

Figure 2. Hypothetical Teacher Productivity Profiles[1]

[1]Hashmarks in bold distinguish among subject areas. Hashmark not in bold distinguish among individual services within service areas.

TABLE 1

Secondary Enrollment Levels and the Sizes of Classes

Full Year Courses Enrollment in Grades 9-12	CORE[1] OFFERINGS				VOCATIONAL[2] OFFERINGS			
	Average Class Size	Fraction of Classes With < 10 Students	Fraction of Classes With < 5 Students	Fraction of Classes With > 20 Students	Average Class Size	Fraction of Classes With < 10 Students	Fraction of Classes With < 5 Students	Fraction of Classes With > 20 Students
100	21.58	.23	.13	.29	15.49	.42	.16	.15
200	22.00	.15	.06	.48	12.43	.39	.10	.11
300	24.36	.15	.08	.55	14.78	.27	.06	.19
400	27.87	.09	.05	.67	16.06	.20	.04	.29
500	26.06	.10	.05	.60	15.56	.22	.10	.21
1,000	26.78	.06	.04	.60	18.94	.17	.07	.37
1,500	25.30	.07	.04	.68	18.55	.08	.03	.42
2,000	25.84	.05	.05	.67	19.47	.11	.04	.42
2,500	25.91	.07	.04	.69	18.97	.08	.04	.38
3,000	26.44	.08	.05	.70	19.39	.11	.06	.47
Part Year Courses Enrollments in Grades 9-12								
100	23.37	.18	.17	.45	15.16	.30	.07	.17
200	22.53	.20	.07	.39	13.28	.40	.08	.12
300	24.43	.13	.05	.42	16.57	.20	.02	.16
400	21.30	.13	.05	.43	14.38	.17	.04	.11
500	20.51	.13	.07	.40	15.18	.22	.06	.14
1,000	26.65	.11	.06	.54	17.07	.16	.07	.16
1,500	27.70	.15	.12	.56	18.81	.06	.03	.35
2,000	24.88	.14	.07	.54	18.26	.12	.07	.22
2,500	26.91	.10	.08	.56	18.18	.09	.04	.23
3,000	25.25	.07	.04	.64	19.04	.07	.03	.35

[1]Core offerings include the following subject areas: English, foreign language (each treated as a separate subject area), mathematics, science, social studies, art, and music.

[2]Vocational offerings include the following subject areas: trade education, technical education, business education, distributive education, home economics, and health occupation education.

TABLE 2

Secondary Enrollment Levels and the Number of Unique Courses Offered

	CORE[1] OFFERINGS				VOCATIONAL[2] OFFERINGS			
	(1) Number of Different Full Year Courses	(2) Number of Different Part Year Courses	(3) (2) ÷ (1)	(4) Total Number of Full Year Equivalent Courses[3]	(1) Number of Different Full Year Courses	(2) Number of Different Part Year Courses	(3) (2) ÷ (1)	(4) Total Number of Full Year Equivalent Courses[3]
100	41.9	7.5	.17	45.65	8.3	5.8	.70	11.20
200	53.0	9.6	.18	57.80	10.3	9.2	.89	14.90
300	55.0	12.7	.23	61.35	13.8	10.3	.75	18.95
400	54.7	15.8	.28	62.60	11.8	12.1	1.03	17.85
500	62.2	12.0	.19	68.20	15.1	10.6	.70	20.40
1,000	79.6	25.1	.32	92.15	18.1	13.5	.75	24.85
1,500	108.2	26.7	.25	121.55	21.4	14.1	.66	28.45
2,000	108.2	34.1	.32	125.25	24.1	19.5	.81	33.85
2,500	118.6	38.9	.33	138.05	32.6	24.0	.74	44.60
3,000	119.7	40.8	.34	140.10	39.5	19.1	.48	49.05

[1]Core offerings indlude the following subject areas: English, Foreign Language (each treated as a separate subject area), mathematics, science, social studies, art, and music.

[2]Vocational offerings include the following subject areas: trade education, technical education, business education, distributive education, home economics, and health occupation education.

[3](1) + .5 (2). Note: Courses o-fered on both a full and part year basis are double counted.

TABLE 3

Secondary School Enrollment Levels and Breadth and Depth of the Curriculum[1]

Enrollments in Grades 9-12	CORE[2] OFFERINGS				VOCATIONAL[3] OFFERINGS			
	Breadth		Depth		Breadth		Depth	
	Number of Subject Areas	Coefficient of Variation Number of Subject Areas	Number of Different Full Year Courses Per Subject Area	C.V.[4] of Number of Different Full Year Courses Per Subject Area	Number of Subject Areas	Coefficient of Variation Number of Subject Areas	Number of Different Full Year Courses Per Subject Area	C.V.[4] of Number of Different Full Year Courses Per Subject Area
100	8.20	7.71	5.11	11.46	2.30	29.35	3.70	36.15
200	9.40	12.49	5.69	12.88	2.70	39.24	3.77	14.39
300	9.10	8.11	6.06	6.51	2.90	34.29	5.03	23.75
400	9.00	7.41	6.08	8.47	2.70	42.95	4.89	36.05
500	9.50	8.95	6.58	13.03	2.90	30.19	5.74	44.84
1,000	10.90	13.98	7.31	11.92	3.40	24.80	5.63	39.30
1,500	12.80	16.39	8.50	9.31	3.60	26.84	6.07	22.77
2,000	12.80	8.07	8.49	12.44	4.70	24.67	5.46	43.84
2,500	12.60	5.55	9.39	12.68	5.10	38.61	6.75	29.92
3,000	12.80	9.60	9.37	10.64	5.90	30.37	6.80	19.10

[1]These data refer exclusively to full year offerings.

[2&3]Same as footnotes 1 and 2 in Table 1.

[4]Coefficient of variation

TABLE 4

Secondary English Course Offerings and Secondary Enrollment Levels[1]

	100	200	300	400	500	1000	1500	2000	2500	3000
English 9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
English 10	.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
English 11	.90	.90	.90	.90	1.00	.90	1.00	.90	1.00	1.00
English 12	.90	.80	.90	.70	.70	.80	.80	.70	1.00	1.00
American Literature	.10	.10	.20		.10	.10	.50	.20	.30	.10
Journalism	.30	.10		.10		.30	.30	.30	.20	.40
Adv. Placement English	.10		.30	.10	.30	.60	.90	.80	.90	.90
Writing Remediation	.50	.80	.50	.60	.30	.30	.70	.60	.50	.90
Other English	.30	.40	.30		.30	.40	.70	.70	.70	.60
Other	.10								.10	.10
Composition and/or Creative Writing		.30	.20	.10	.20	.20	.30	.20	.60	.50
British Literature		.10	.30		.10		.30	.30	.40	
Writing Lab		.20	.10	.10	.20	.30	.60	.20	.40	.60
Contemporary Literature		.10	.10			.10	.30	.10	.30	.20
Language (History and Semantics)		.10						.10		
Writing Workshop				.20				.20	.60	
Science Fiction				.10			.20		.10	
Mass Media Communication					.10		.30	.20	.40	.10
World Literature						.10	.30	.20	.10	.20
Bible as Literature						.10			.10	
Fiction						.10			.10	
Speech (not corrective)						.10	.10		.10	
Film Study						.10		.10		.10
Theater Arts and/or Play Production						.10	.40	.10	.30	.10
English Humanities						.20	.20	.30	.10	.30
Novel						.10		.20	.10	
Shakespeare						.10	.10	.10	.10	.10
Reading Skills							.20	.20	.50	.40
Dramatic Literature							.20	.10	.10	
Poetry							.10	.10		
Debating							.10		.10	
Independent Study							.20			.10
Mystery							.10	.10	.10	.10
Sports in Literature							.20		.10	
Mythology								.10	.10	
Nonfiction								.10		
Public Speaking								.10		.10
Short Story									.20	.10

[1]Cell entries are the fraction of school districts with the indicated enrollment level that offer the indicated course. An empty cell indicates that none of the school districts offered the course.

TABLE 5

Secondary Foreign Language Course Offerings and Secondary Enrollment Levels[1]

	100	200	300	400	500	1000	1500	2000	2500	3000
French I	.50	.80	.50	.90	1.00	1.00	.80	.90	1.00	1.00
French II	.40	.80	.60	.90	1.00	1.00	.90	1.00	1.00	1.00
French III	.20	.70	.50	.80	1.00	1.00	.90	1.00	1.00	1.00
French IV	.10	.10	.10	.20	.80	1.00	.90	1.00	.90	.70
French-College Credit			.10			.20	.30	.20	.10	.30
Other			.10					.10		.10
Other French					.10	.10		.10	.10	.20
French V						.10	.40	.80	.50	.20
French VI							.20		.10	.10
French (not Regents)								.10	.10	.10
Spanish I	.40	.40	.70	.80	.60	1.00	1.00	1.00	1.00	1.00
Spanish II	.60	.40	.80	.80	.60	1.00	1.00	1.00	1.00	1.00
Spanish III	.60	.40	.70	.80	.60	1.00	1.00	1.00	1.00	1.00
Spanish IV	.20	.30		.10	.50	1.00	.90	.90	.90	1.00
Spanish V		.10				.10	.50	.50	.50	.40
Other Spanish			.10			.10	.30	.40	.10	.20
Spanish-College Credit						.10	.30	.20		.30
Spanish (non Regents)						.10	.20	.10	.30	.10
Spanish VI							.10		.10	
Spanish For Native Speakers of Spanish							.10	.10	.10	.20
Latin I		.30	.20	.10	.40	.40	.60	.90	.60	.80
Latin II			.20	.10	.40	.40	.50	.90	.20	.70
Latin III (Prose)			.10	.10	.30	.30	.20	.50	.20	.40
Latin IV (Poetry)					.10	.10	.20	.30		.20
Other Latin					.20	.10	.10			
Latin IV (Prose)						.10				
Latin-College Credit						.20	.10	.10		
Latin (non Regents)									.10	
Latin VI										.10
German I						.30	.50	.60	.70	.50
German II						.30	.50	.70	.80	.70
German III						.30	.50	.70	.80	.50
German IV						.10	.30	.90	.80	.30
German-College Credit							.10			
German V								.20	.30	.10
German VI								.10		.10
Other German								.10		.10
Italian I						.10	.40	.40	.50	.70
Italian III						.10	.50	.50	.40	.50
Other Italian						.10			.10	.20
Italian II							.40	.40	.40	.80
Italian IV							.10	.20	.10	.40
Italian V								.20		.10
Other										.10
Hebrew I						.10	.10			
Hebrew II							.10			
Hebrew III							.10			
Russian I							.10			.10
Russian II							.10		.10	
Russian IV							.10		.10	
Russian III									.10	
Russian V									.10	
Other Russian									.10	
Japanese						.10	.20			.10
Catonese Chinese							.10			
Ancient Greek							.20	.10		
Portugese							.10			
Polish								.10		
Arabic										.10

[1]Cell entries are the fraction of school districts with the indicated enrollment level that offer the indicated course. An empty cell indicates that none of the school districts offered the course.

TABLE 6

Secondary Mathematics Course Offerings and Secondary Enrollment Levels[1]

Course Title	100	200	300	400	500	1000	1500	2000	2500	3000
General High School Math	1.00	1.00	.90	1.00	1.00	.90	.80	.90	1.00	1.00
Math 9										
Algebra, 1 year	.60	.30	.20	.60	.20	.40	.30	.20	.70	.80
Algebra, 2 years	.20	.20		.10	.10	.10	.10	.20	.50	.40
3-Year Sequence Course I (Regents)	.40	.80	.90	.60	1.00	.70	.80	1.00	.80	.80
Experimental SSMCIS	.20							.10	.20	
Math 10										
1 year	.50	.60	.60	.60	.50	.40	.40	.50	.60	.80
NM Regents	.10		.20	.30	.10	.30	.20	.30	.60	.80
Experimental SSMIS	.30	.40	.40	.40	.50	.60	.80	.80	.70	.60
Math 11										
1 year	.10	.10		.30	.20	.50	.70	.80	1.00	1.00
1½ years	.60	.70	.70	.60	.60	.50	.50	.60	.80	.90
3-Year Sequence Course III	.30	.20	.20	.40	.30	.60	.70	.80	.70	.60
Math 12A	.20	.10		.20		.30	.40	.30	.20	.50
Math 12X	.50	.40	.50	.70	.60	.40	.70	.90	.80	.70
Senior General Math(Consumer Math)	.10	.10	.10	.10	.10	.20	.10	.10	.20	.20
Intro to Calculus	.10	.30	.10	.60	.50	.10	.30	.40	.20	.50
Computer Mathematics	.10	.30	.20	.20	.40	.30	.60	.60	.80	.70
Selected Topics in Advanced Math	.10	.20	.10	.10	.10	.10	.40	.20	.20	
Other Math	.20	.20	.10	.10	.30	.30	.50	.40	.40	.80
Other	.10		.10	.10			.10	.20	.30	
Math 9 (Pre Algebra)		.10	.20	.50	.40	.30	.30	.40	.50	.80
Trade Math		.10	.10					.10		.10
Trigonometry		.10			.10	.20	.20	.40	.30	.50
Math Using Calculators		.10	.10	.20	.20	.60	1.00	.70	1.00	.90
Advance Placement Math		.10	.10		.10	.30	.50	.80	.50	.40
Statistics		.10					.10			.10
Math 9, 1½ years			.10					.20	.10	.20
3-Year Sequence Course I (2 Years)			.20		.30	.20	.40	.30	.40	.20
Applied (Related 12th year Math			.10	.10					.10	.50
Probability and Statistics					.10	.10		.10		.10
Math Seminar Problem Solving					.10		.10	.10	.10	
Experimental Math 11 UICSM Vector					.10	.10	.20	.10		
3-Year Sequence Course I (1½ years)						.20	.40	.50	.30	.10
Intermediate Albebra						.20	.20	.40	.30	.20
Math Analysis						.10	.20		.20	.10
Elementary Functions						.10	.10	.10	.10	
Analytic Geometry						.10			.10	
Laboratory Math						.10	.50	.50	.50	.50
Math 10 (1½ years)							.20			
Math 10 (SMSG Geometry)							.10			.30
Matrix Algebra							.10	.10	.10	.20
Experimental Math 10 SSMCIS								.10	.10	
3-Year Sequence Course II (Math 10)								.30	.10	.10
3-Year Sequence Course III (Math 11)								.10	.20	.10
Experimental Math 11 SSMCIS								.10	.10	
Shop Math								.20	.10	.20

[1]Cell entries are the fraction of school districts with the indicated enrollment level that offer the indicated course. An empty cell indicates that none of the school districts offered the course.

TABLE 7

Secondary Science Course Offerings and Secondary Enrollment Levels[1]

Course Title	Enrollment in Grade 9-12									
	100	200	300	400	500	1000	1500	2000	2500	3000
Biology										
Biology (Regents)	.90	1.00	1.00	1.00	1.00	1.00	.90	1.00	1.00	1.00
General Biology State Group III	.10	.10	.20	.30	.30	.30	.50	.70	.80	.90
Biology (Local)	.10	.30	.50	.40	.20	.60	.80	.60	.60	.80
Marine Biology	.10					.10	.10			
Environmental Studies	.10			.10		.20	.30	.40	.20	.30
Biology (Second Year)		.30			.10	.10		.20	.10	
Biology (Local Group III)			.10		.10	.20	.10		.20	.30
Adv Placement Biology			.30	.10	.20	.50	.60	.60	.70	.80
Other Biology			.10		.20	.20	.40	.40	.50	.20
Biology w/College Credit							.20		.20	.20
Physiology								.10		
Botany										.10
Chemistry										
Chemistry (Regents)	.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Chemistry (Local)	.10		.20	.10		.30	.40	.40	.20	.20
General Chemistry State Group III		.10	.10		.30	.30	.50	.90	.80	.50
Chemistry (Local Group III			.20	.10			.10	.20	.20	.30
Chemistry w/College Credit							.10		.20	
Adv Placement Chemistry					.10	.30	.40	.60	.50	.50
Other Chemistry					.20	.10		.10	.20	.20
Chemistry (Second Year)									.10	
Physics										
Physics (Regents)	.70	1.00	.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Physical Science (Local)	.10			.20	.10	.40	.40	.40	.80	.40
General Physic State Group III				.10	.10	.10	.30	.40	.40	.40
Physics (Local)				.10	.10	.20		.10	.20	.30
Other Physics					.10			.20	.20	.10
Adv Placement Physics						.10	.40	.40	.50	.60
Physical Science Group III						.10	.10			
Astronomy without Planetarium						.20	.10			.10
Project Physics							.10	.10		.10
Physics Local Group III									.20	.10
Astronomy with Planetarium										.10
Space Science										.10
Earth Science										
Earth Science (Regents)	.20	.90	.90	.80	.80	.80	.80	.90	.80	.90
Earth Science (Local)		.40	.60	.30	.40	.40	.70	.60	.50	.60
Earth Science (Local Group III)					.20	.10	.10		.30	.10
Other Earth Science						.10	.10		.20	
Geology (Local)									.10	
Other Science		.20		.30	.40	.40	.60	.50	.70	.80
Unified Science					.10		.20		.10	
The Man Made World						.10				
Science Seminar									.10	
Other										.10

[1]Cell entries are the fraction of school districts with the indicated enrollment level that offer the indicated course.

An empty cell indicates that none of the school districts offered the course.

TABLE 8

The Percentage of Students Enrolled in Courses
Not Offered by Schools With 100 Pupil Enrollment Levels

Schools' Enrollment Level	English	Foreign Language	Mathematics	Science
500	7.56	5.02	8.84	18.36
1000	11.65	8.45	11.04	14.11
1500	17.01	13.49	15.50	18.85
2000	26.05	12.42	17.32	15.98
2500	20.07	8.50	12.26	22.49
3000	11.47	9.38	10.85	10.63

TABLE 9

Histograms Describing the Relationship Between
The Number of Unique Secondary English Courses Offered and
Secondary Enrollments Levels

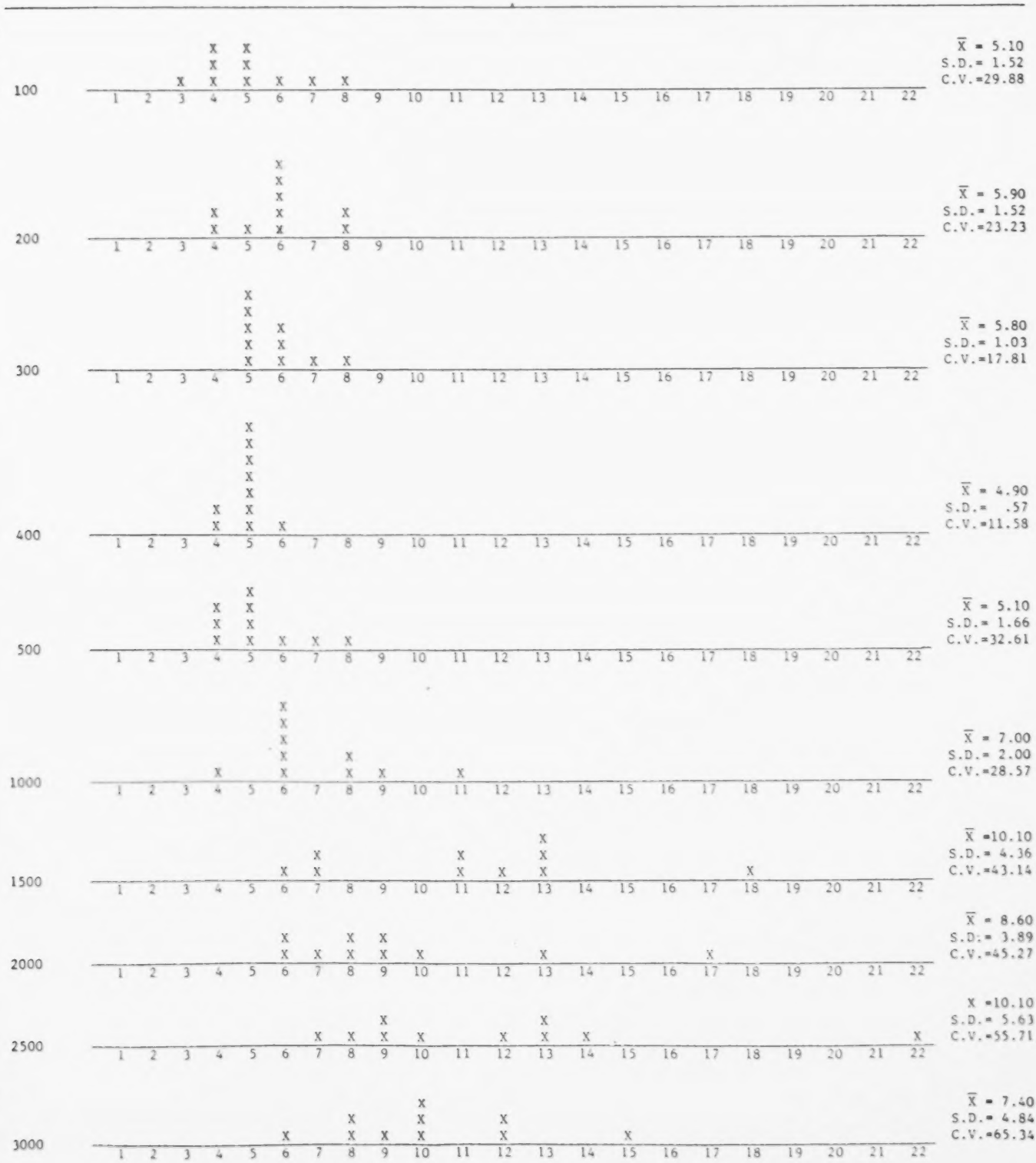

TABLE 10

Histograms Describing the Relationship Between
The Number of Unique Secondary Foreign Languages Courses Offered
and Secondary Enrollment Levels

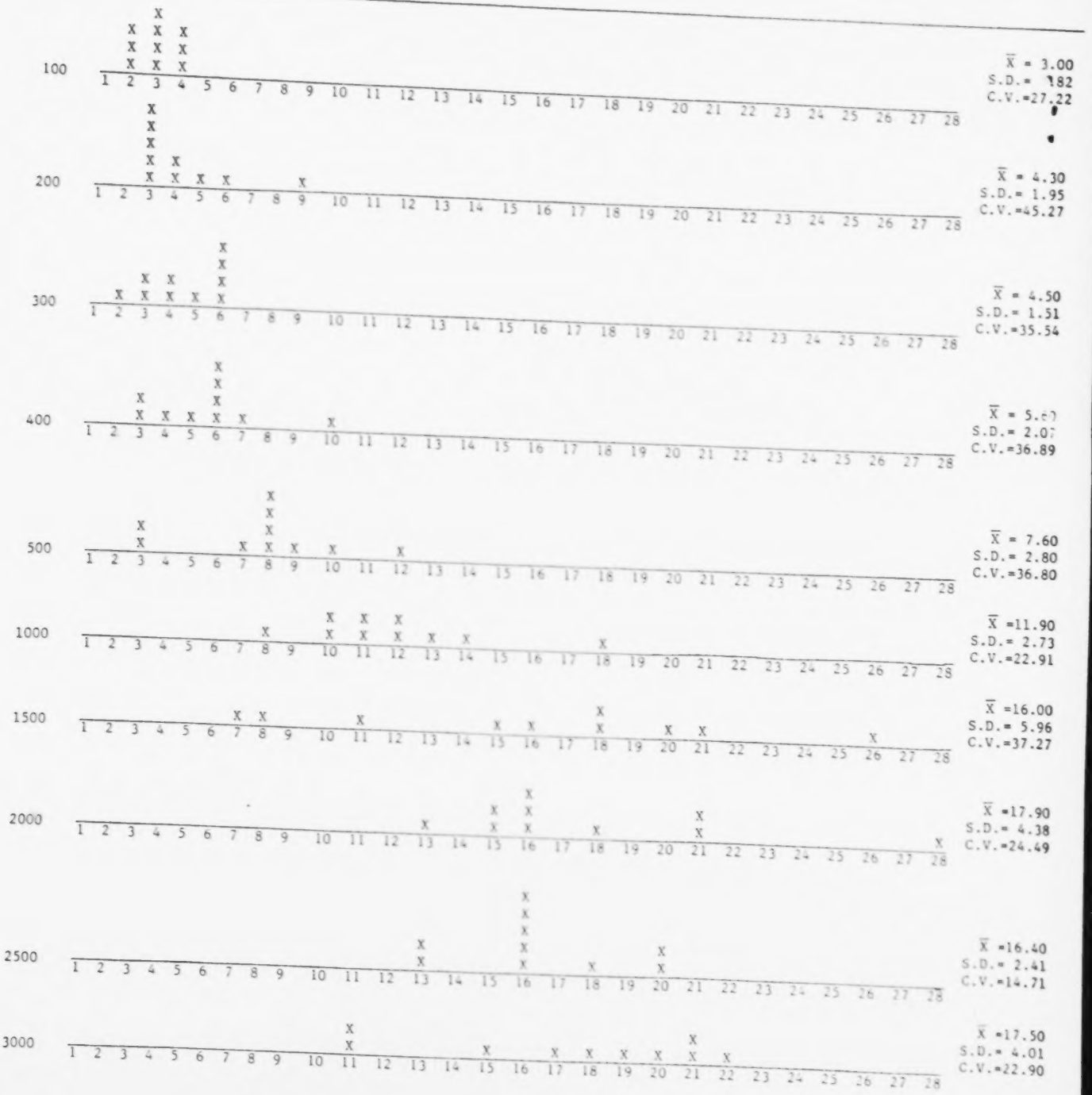

TABLE 11

Histograms Describing Relationships Between
The Number of Unique Secondary Mathematics Courses Offered
and Secondary Enrollment Levels

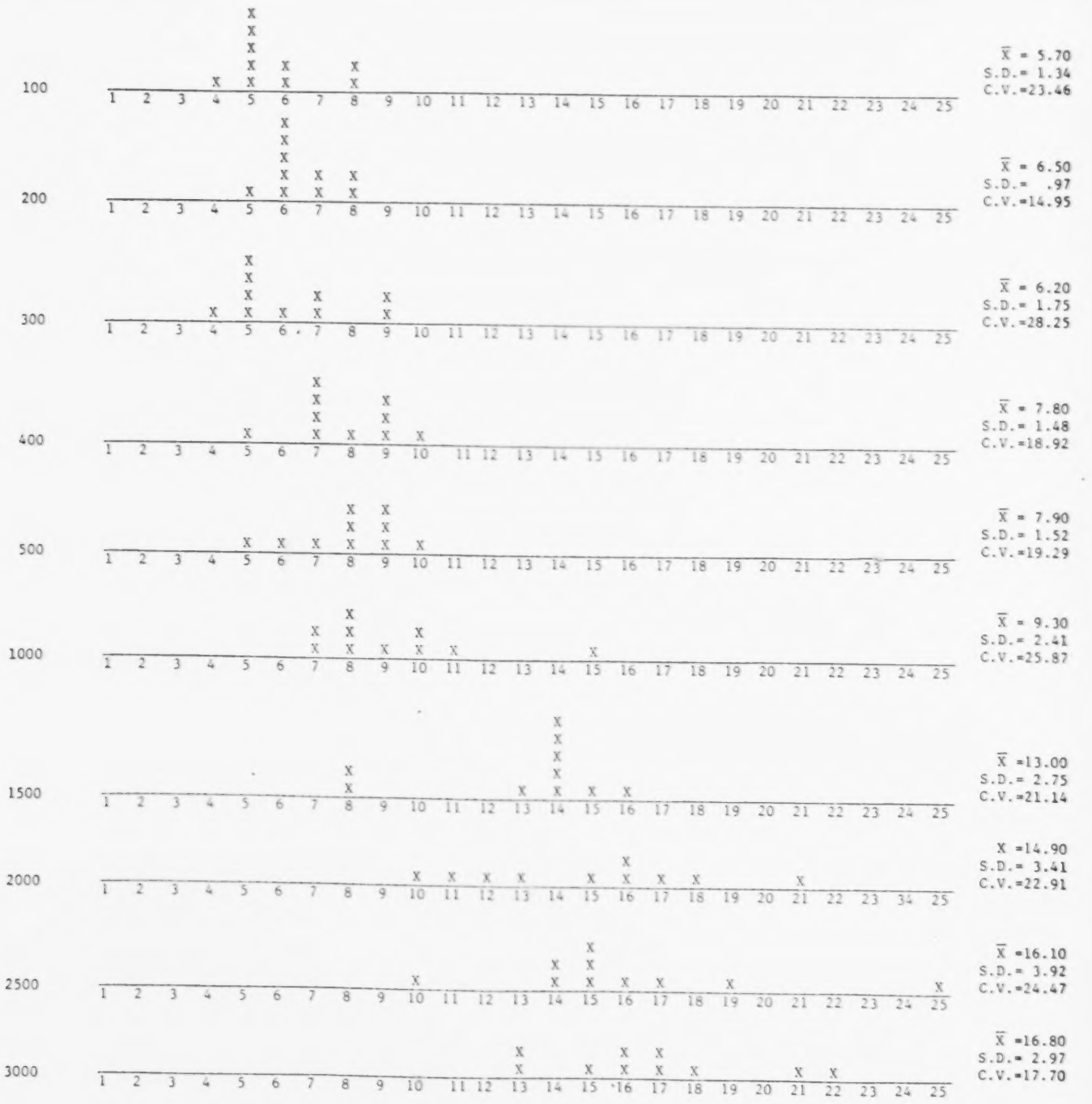

TABLE 12

Histograms Describing the Relationship Between
The Number of Unique Secondary Science Courses Offered and
Secondary Enrollment Levels

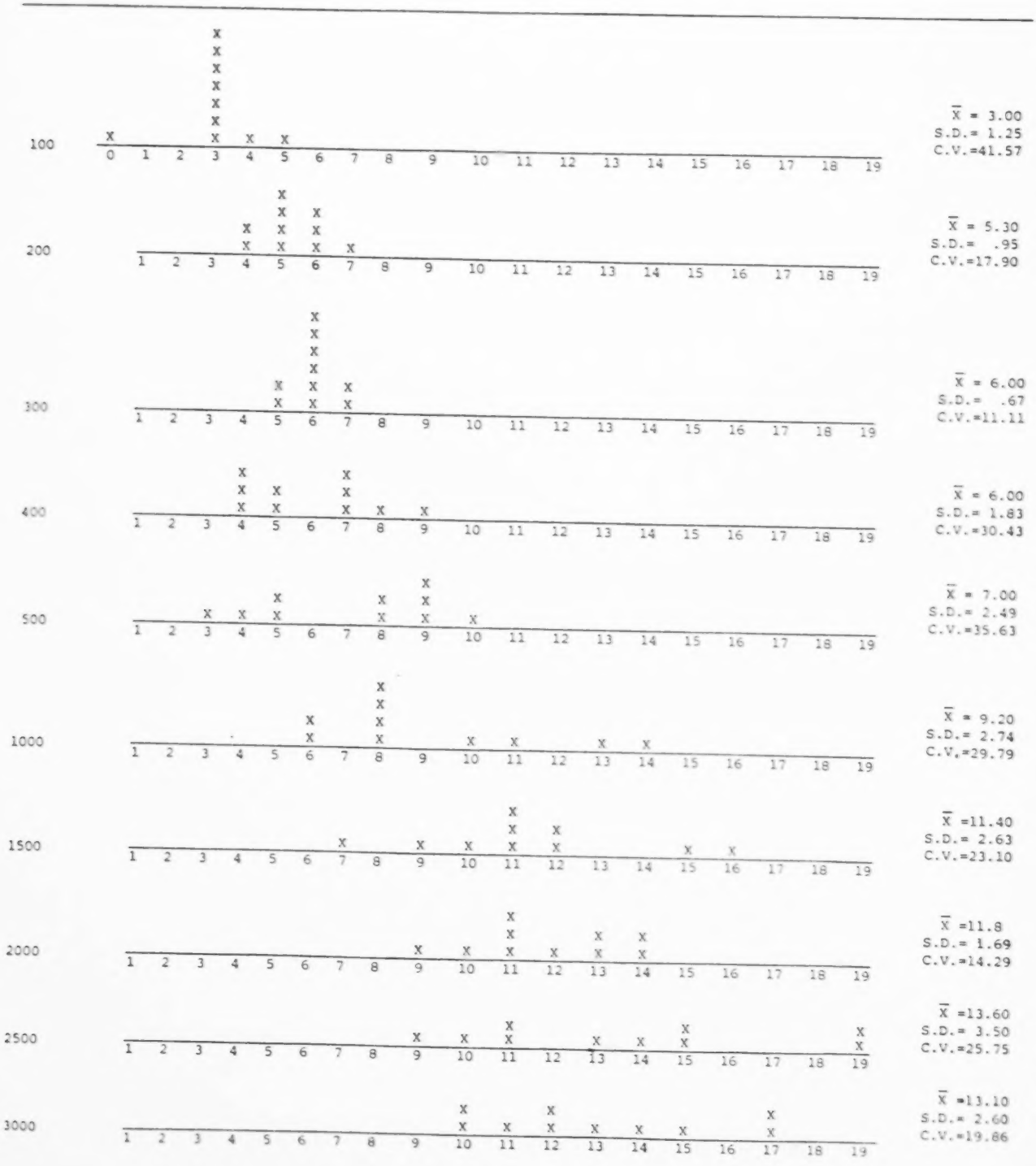

TABLE 13

Secondary School Enrollment Levels and Accessibility to Course Offerings[1]

	CORE OFFERINGS[2]			VOCATIONAL OFFERINGS[3]		
Enrollment in Grades 9-12	Average Number of Sections Offered of Each Course	Fraction of Unique Courses Offered as Singletons[4]	Number of Singletons[4] Per Subject Area	Average Number of Sections Offered of Each Course	Fraction of Unique Courses Offered as Singletons[4]	Number of Singletons[4] Per Subject Area
100	1.48	.72	4.25	1.08	.93	3.47
200	2.15	.51	3.61	1.08	.94	3.53
300	2.68	.45	3.43	1.22	.82	5.05
400	3.26	.38	2.97	1.39	.67	3.81
500	3.49	.39	3.30	1.41	.72	4.28
1,000	4.46	.36	3.22	1.77	.49	2.98
1,500	5.76	.33	3.22	2.38	.40	2.91
2,000	6.83	.33	3.35	2.54	.42	2.88
2,500	8.57	.26	3.03	3.12	.33	2.87
3,000	9.00	.29	3.21	3.33	.31	3.12

[1] These data refer exclusively to full year course offerings.

[2] Core offerings include thef following subject areas: English, foreign language (each treated as a separate subject area), mathematics, science, social studies, art, and music.

[3] Vocational offerings include the following subject areas: trade education, technical education, business education, distributive education, home economics, and health occupation education.

[4] A singleton is a course that is offered at a single time. It is a single section course.

TABLE 14

Secondary School Enrollment Levels and the Assignment of Teachers to Classes[1]

	Measures of Teachers Load				Measures of Specialization Across Subject Area[2]		Measures of Specialization Within Subject Areas[2]	
	(1) Average # of Full Year Classes Taught by Full-Time Teachers	(2) Average # of Part Year Classes Taught by Full-Time Teachers	(3) Total Average # of Classes Taught by Full-Time Teachers (1)+.5(2)	(4) Average # of Different Preparations For Full Year Classes For Each Teacher	(5) Average # of Different Subject Areas Taught by Full-Time Teachers	(6) Fraction of Full-Time Teachers Teaching in Two or More Subject Areas	(7) Fraction of Full-Time Teachers Teaching Two or More Sections of the Same Course	(8) Fraction of Full-Time Teachers Teaching Three or More Sections of the Same Course
100	4.65	1.05	5.18	3.34	1.32	.25	.29	.13
200	4.75	1.22	5.36	2.73	1.29	.26	.53	.28
300	4.56	1.02	5.07	2.27	1.17	.15	.55	.39
400	4.71	1.01	5.22	1.99	1.10	.10	.72	.52
500	4.62	.79	5.02	1.94	1.13	.13	.67	.49
1,000	4.28	.98	4.77	1.91	1.12	.11	.67	.47
1,500	4.48	.70	4.83	1.93	1.14	.12	.72	.50
2,000	4.30	.93	4.77	2.42	1.10	.09	.72	.51
2,500	4.44	.79	4.84	2.39	1.13	.10	.71	.50
3,000	4.27	.79	4.67	2.48	1.09	.08	.72	.50

[1] Columns 4-8 refer exculusively to full year courses; Columns 1-3 refer to full year and part year offerings as indicated. A full year course meets for more than 20 weeks per year. A part year course meets for 20 or fewer weeks per year.

[2] Subject areas refer to broad areas of the curriculum such as mathematics and English. Subject areas do not refer to specific courses such as algebra or English composition.